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NOTES FROM PACIFIC COAST OBSERVATORIES.

NOTE ON THE PLANETARY NEBULÆ.

The planetary nebulæ form a very interesting subdivision of the great class of nebular objects. By their small size, clear-cut and sharply-defined character they are differentiated from the great diffuse nebulosities on the one hand, and from the great class of spirals on the other hand both by their distribution in the sky and by their spectrum. Relatively to the entire number of the stars they are rare objects; less than one hundred and fifty are known, and they may possibly be a sporadic case of stellar evolution. The complex and puzzling internal motions which are now being discovered in these objects by means of the spectrograph have opened up a new and highly interesting field.

Their small size, and the great contrasts in the intensity of the inner and outer portions of many of these objects make it almost impossible to illustrate their form by direct photographic enlargements. The most satisfactory method has proved to be to make composite drawings from a series of exposures of each object, ranging from a few seconds to an hour or more. Such reproductions of all the planetary nebulæ accessible from the northern hemisphere have been made, and will shortly be published by the Lick Observatory; six typical objects of the class are shown on the page facing this note, several of which are referred to in the notes by Messrs. Campbell and Moore, published elsewhere in this number.

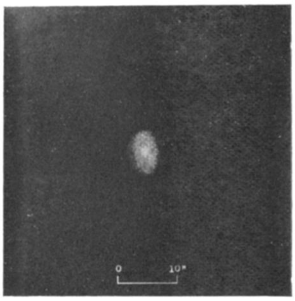
A brief description of these objects follows:

N. G. C. I 351: This object is a minute oval disk about 8″ by 6″ in position angle about 10°; an elongated brighter patch in the center can be seen, and a faint nucleus. Quite bright.

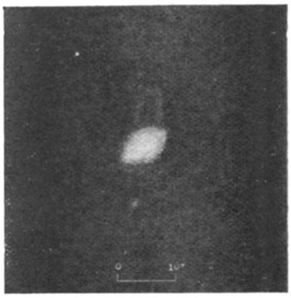
Jonckheere 320: A central star surrounded by a rather bright oval of nebular matter, 7″.7 by 4″.8 in short exposures. Long exposures show a faint ring formation 22″ long in position angle 168°. The brighter central oval shows a very indistinct ansa or edgewise ring effect.

N. G. C. 6058: This is an irregular oval, 25″ by 20″, very

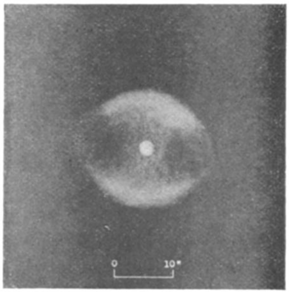
PLATE IV.



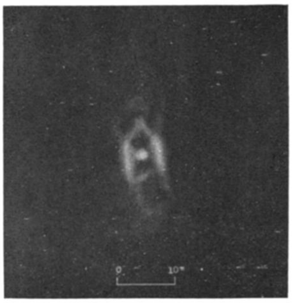
N. G. C. I. 351.



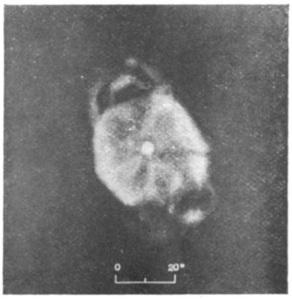
Jonckheere 320.



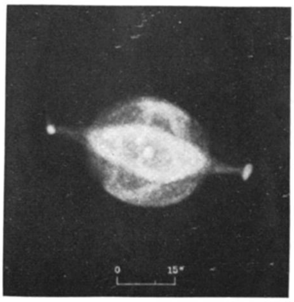
N. G. C. 6058.



N. G. C. 7026.



N. G. C. 40.

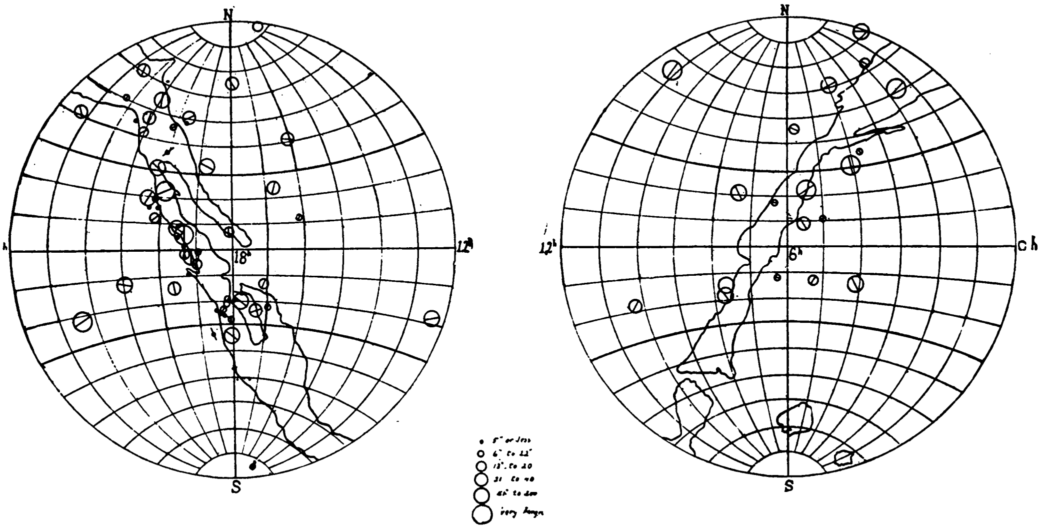


N. G. C. 7009.

Drawings of Six Planetary Nebulæ.

much fainter along its major axis in position angle 77°, with a fairly bright stellar nucleus. This form, somewhat resembling the Dumb-Bell Nebula, is fairly typical.

N. G. C. 7026: This is a very irregular object, unique among planetary forms thus far observed. The shortest exposures show two elongated, slightly curved lobes 5″ long, symmetrically placed on each side of a faint central star, and 6″ apart from center to center. In longer exposures the central parts take the form of an H, and irregular wisps are seen at each end, making the total length about 25″.



DISTRIBUTION OF THE PLANETARY NEBULÆ.

N. G. C. 40: A beautiful object; strong stellar nucleus; the nebula resembles a truncated spherical shell, from the ends of which extend much fainter wisps. Its total length along the major axis in position angle 14° is about 60″.

N. G. C. 7009: One of the brightest and most interesting objects in the planetary class, and evidently of a very complicated structure. The slightly oval disk is about 30″ by 26″, while the almost stellar condensations at the ends of the ansæ are 48″ apart in position angle 79°.

I have plotted, as shown in the cut above, all the planetary nebulæ to about 33° south declination. The black dots represent the smallest objects, while the small circles indicate by their increasing size the various sizes of planetary nebulæ. A line indicates on each circle or dot the position of the major axis of the planetary; where no line is drawn the object is round. It will be seen that the lines indicating the positions of the major axes are random in their arrangement, and that there is no apparent tendency for the major axes to be arranged parallel to any one given plane, *e. g.*, that of the Milky Way.

Considering the arrangement of the planetaries by apparent size, a very interesting feature is at once noted. Like most celestial objects (excepting, of course, the spiral nebulæ), the planetaries are emphatically a galactic phenomenon, showing a strong tendency to group themselves in or near to the Milky Way. Now practically all the smaller objects of the class are in or very close to the Milky Way. On the other hand, the larger ones, and the giants of the class, are fairly well distributed over the sky. This is just the distribution which would be expected if the larger planetaries were really, as indicated by their apparent size, the nearer to us. It would then seem that the larger planetaries are very favorable objects for inclusion in parallax programs; the evidence, both of apparent size and distribution, points to the fact that they are relatively near objects, and the great majority of them have central stars on which measures could easily be made.

H. D. Curtis.

Four Nebulæ with Bright-line Spectra.

As far as we know, nothing has hitherto been published concerning the spectra of the four bright planetary nebulæ listed below. We have observed all of them for radial velocity by means of 3-prism spectrographs, and have found their spectra to be of the usual bright-line type. The continuous spectrum of the fourth object, N. G. C. 6058, is unusually strong for a planetary nebula, and the spectrum should be studied further.

	α (1900)	δ (1900)
N. G. C. Index 351	$3^h\ 41^m.1$	$+34°\ 45'$
Jonckheere 320	5 0 .0	+10 34
Jonckheere 900	6 20 .1	+17 51
N. G. C. 6058	16 1 .0	+40 57